Densities Obtained from Drag on the Explorer XVII Satellite

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Orbit elements for the active experiment lifetime of the satellite Explorer XVII have been obtained and utilized in the determination of atmospheric density in the region of the perigee of the satellite. The differential corrections, using minitrack interferometer data, covering data arcs of approximately seven days, were carried out by personnel of the Data Systems Division of the Goddard Space Flight Center.

Figure 1 shows density versus a converted local solar time. The angle between vectors from the center of the earth to perigee and to the sun (zenith angle) has been converted to an equivalent local solar time for comparison with the Harris-Priester model atmosphere (1962). The density determinations were made by utilizing the formulas of D. G. King Hele (1960). These formulas give the density one-half a scale height above the perigee height and require an assumed scale height for calculation. The scale height assumed was thirty kilometers and hence the densities given are to be associated with an altitude of two hundred seventy kilometers. An overall confidence bound of ± 10 % could be applied to each data point. The data are plotted as obtained and also with an adjustment for the

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twenty-seven day variation of density with solar 10.7 centimeter flux. The adjustment is made because the Harris-Priester model does not include this short period effect. The solid line on the figure is the Harris-Priester model curve for S = 100.

In Figure 2, the abscissa is the local solar time at perigee. The solid curve is an interpolated Harris-Priester model curve adjusted to fit the data and resulting in an approximate S number of ninety three.

The two figures are presented because the actual shape of the diurnal bulge is still not known. The first figure places the functional dependence on an angle between perigee and the sun and the second on the local solar time.

On both figures the time covered is indicated by the dates at the bottom. The first epoch is April 4, 1963 and the last, July 6, 1963.

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REFERENCES

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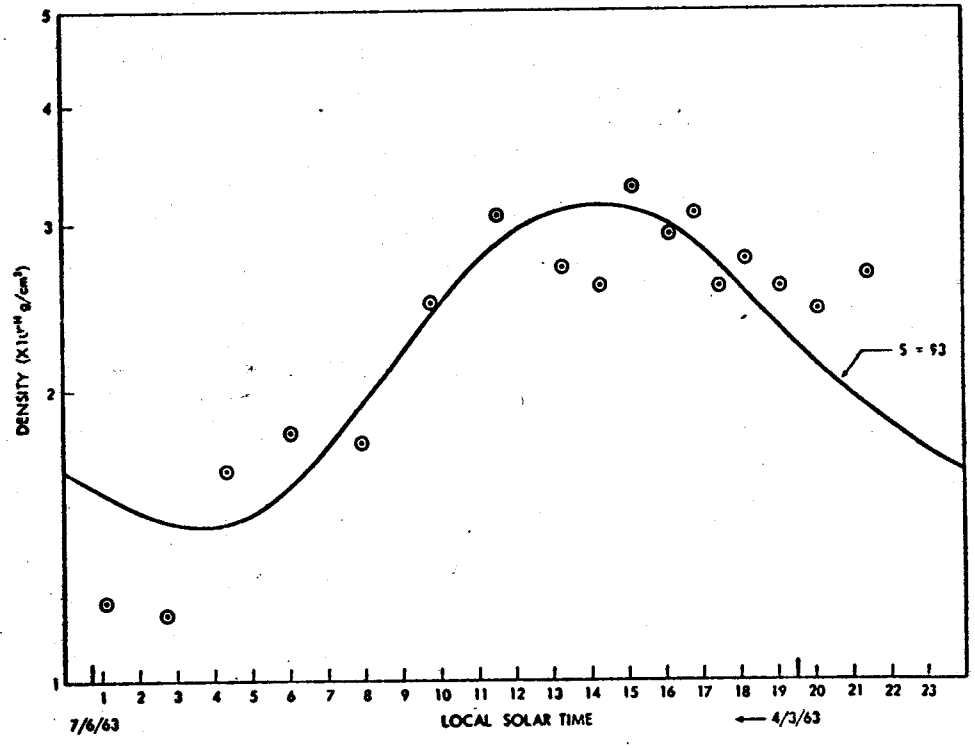
King-Hele, D.G., Method for Determining the Changes in Satellite Orbits due to Air Drag, Space Research, Proceedings of the First International Space Science Symposium, edited by H. Kullman - Bijl, New York: Interscience Publishers, 1960 pp 8-23.


DENSITY (X10⁻²⁴ g/cm³)
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
LOCAL SOLAR TIME
7/6/63
← 4/3/63
S = 93

CAPTIONS FOR FIGURES

1. Fig. 1 Density versus converted zenith angle

2. Fig. 2. Density versus local solar time